

Who Are We:

Briefly describe your museum and laboratory: Phipps’ mission is to inspire and educate all with the beauty and importance of plants; to advance sustainability and promote human and environmental well-being through action and research; and to celebrate its historic glasshouse. Annually Phipps attracts more than 350,000 guests. The Living Laboratory serves the mission of our museum by, “promoting human well-being through action and research.” The research conducted on site at our museum engages visiting families through interactions with children and open discussions with adults regarding child development and exploration. Visitors to the conservatory that interact with the “Discovery Process Lab” research team have the potential to gain a better understanding of how children learn and explore, and may become more consciously aware of how they, and other adults, are interacting with their children and how those interactions may be affecting their learning and exploration.

What is your lab’s overall research focus? Dr. David Klahr’s Discovery Process Lab is committed to furthering our understanding of children’s scientific thinking and problem-solving, important components of contemporary science education. The lab studies cognitive development by presenting children with games that encourage them to independently explore new physical and virtual environments. In particular, current studies under postdoctoral researcher Dr. Audrey Kittredge’s supervision focus on young children’s independent exploration and experimentation, and on the ways that teachers and other adults may shape children’s learning of these skills.

How and when did the partnership start? Why Living Laboratory? Phipps’ participation in the National Living Lab program is an effort to expand science communication to scientists working in child psychology research. The first year (2013-2014) of Phipps’ involvement with the National Living Lab program allowed Phipps to involve visitors in the process of research. This year (2014-2015) Phipps expanded this effort to include non-participating visitors, as well as mutual professional development for both partners.

What’s your history together? Any previous history with Living Laboratory? Phipps had a Living Laboratory partnership together with Dr. Anna Fisher’s Cognitive Development Lab at Carnegie Mellon University in 2013-2014. Dr. Audrey Kittredge from the Discovery Process Lab approached Phipps Conservatory in the fall of 2013, and a (non-NLL) collaboration began at that time. Melissa Harding and Dr. Audrey Kittredge applied for a National Living Lab stipend together in the summer of 2014.

Details about Living Laboratory site: What does it look like? The Living Laboratory site in Phipps Conservatory is located in the vestibule of the Tropical Forest Room, the largest of the indoor exhibits. There are two six-foot tables set up on one side of the vestibule in a small alcove, along with a smaller data collection table and chairs. Signage is also placed throughout the conservatory directing guests to the researchers in the Tropical Forest vestibule. (Also see figures 1-6: NLL Final Stipend Report Appendix A).



Fig 1. Researcher station



Fig 2. Researchers



Figure 3. Tropical Forest vestibule



Figure 4. Data collection area

How often do your visitors interact with Living Laboratory activities, and in what ways? Guests engaged with the researchers by actively participating the study taking place at the museum during the time of their visit, and by speaking with the researchers (stationed at the data collection table in the Tropical Forest vestibule, at the entrance greeting visitors, or traveling throughout the museum to recruit visitors). The Discovery Process Lab made a total of ten visits this year to Phipps. Visits generally took place on Saturdays (and occasionally on weekdays), and lasted 4 hours (split between a morning shift and an afternoon shift, and not including set-up and take-down time).

Goals of the NLL Stipend Award: There were 9 goals in our current partnership: (1) Visitors contribute to the process of scientific discovery through participation in active studies, (2) Visitors engage in one-on-one educational interactions with scientists conducting the research, (3) Visitor education focuses on the process of science, increasing interest in and understanding of research “questions and methods” as well as “results”, (4) Studies occur in plain-view of the public, on the exhibit floor, (5) Non-participant visitors talk with researchers and learn about on-going studies in ways similar to study participants, (6) On-site research is an expected and predictable part of the visitor experience, (7) Researchers

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receive training from museum staff in effective museum-style education techniques, improving researchers' communication skills with public audiences, (8) Museum educators gain direct access to current science that is relevant to their work with the public, improving educators' understanding of science and its potential application to their practice, and (9) Museum educators and researchers communicate regularly, collaboratively monitoring the program to ensure scientific and educational goals are met, and that programmatic needs (e.g. logistical, financial) are fulfilled.

Enhancing the Visitor Experience:

How has Living Laboratory enhanced the visitor experience at your site? Living Laboratory has enhanced the visitor experience at our site by providing museum guests with a unique, free-of-cost educational opportunity to learn about research and developmental/educational psychology in particular. In addition to this, Living Laboratory has also provided guests with a more realistic portrait of scientists and science-based careers by granting visitors a chance to interact directly with researchers as they are conducting their work. Living Laboratory may also encourage lifelong learning by re-instilling an interest in the sciences. A total of 42 children participated in the study, and there were approximately an additional 140 Educational Opportunities with non-participating visitors. (As Research Assistants had difficulties keeping track of non-participant Educational Opportunities, this number was estimated). On an average visit day, approximately 4 children participated in the study (range: 0-9 children) and there were approximately 14 additional educational opportunities.

Quote from a visitor about their Living Laboratory experience, and picture: "I am intrigued by the concept of a collaboration between a museum and a lab, and think it is an interesting way to get the community involved in research." (paraphrased)



Figure 5. Greeting families



Figure 6. A child participates in a study

Mutual Professional Development:

Who is on your Museum and Academic Living Laboratory Team? *Museum Team:* Lorren Kezmoh (Coordinator); Adam Haas (Marketing); Emily Kalnicky (Director); Kelliann Walsh (Greater); Michele Grygo (Logistics); Melissa Harding (Previous Coordinator). *University Team:* Audrey Kittredge (Living Laboratory PI, Postdoctoral Researcher); David Klahr (Head of Lab, Professor); Jae-Won Kim (Lab Manager); Sruthi Ramesh, Zenon Cheng, Francois Ban, Tejasvi Gowda (Undergrad RAs).

What forms of Mutual Professional Development (MPD) have you implemented, and who has been involved? Thanks to this award, museum staff have gained an increased understanding of scientific thinking and the process of scientific research and discovery, as well as an enhanced scientific communication skillset. The "Lunch & Learn" session led by Dr. Audrey Kittredge was one of our more popular sessions, with 15 RSVPs and 11 completed surveys at the session. Comments from staff suggested they enjoyed the talk and appreciated learning about the research. Dr. Kittredge also set up and staffed a table as part of Phipps' "Ask a Scientist" series. At this event Audrey told visitors about the lab's research and the NLL partnership, accompanied by demonstrations using stimuli from the studies that the Discovery Process Lab conducted at Phipps. A total of 54 visitors (18 children, 36 adults) stopped by to speak with Audrey, and feedback forms

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suggested that the visitors enjoyed this experience. Discovery Process Lab Staff also learned a great deal from these experiences, as well as from a workshop led by Phipps staff on how to engage with museum visitors.

Quotes from museum staff and researchers regarding their experience with Living Laboratory:

- “As an educator in the conservatory, readily available information from the researchers about effective approaches to/informative educational experiences has been very helpful for our own educational programming implementation.” –Museum Educator, March 26th, 2015
- “[Phipps] was a great atmosphere to be in... The most important thing I've learned from Phipps is that people are usually willing to learn more and contribute to their community when it comes at minimal cost to them, and that there's never harm in trying.” – Sruthi Ramesh, Research Assistant, May 2015
- “There were often times where people without children would come up to the table to see what we were doing. They were genuinely interested in the research and had never heard of getting participants from a museum... I learnt better communication skills since I had to approach people I did not know. I always thought of research pertaining to the scientific community, but through this experience I learnt about how important it is for the general population to learn about research and to be invested in it.” – Tejasvi Gowda, Research Assistant, May 2015
- “I had an eye-opening experience engaging with the public to discuss our lab’s research as part of the “Ask a Scientist” series. I never realized how much enjoyment one can get from sharing the results of our research with museum visitors, or how challenging it is to truly educate visitors about our work and its significance. I want so much to learn how to be an even better educator and advocate for research on children’s learning. Even before this experience I was interested in outreach, but now I’m in love with it!” – Audrey Kittredge, postdoctoral researcher, May 2015

Research Happenings at Our Site:

Research question(s) and methods: Although middle school students often struggle to design “controlled experiments” (investigations that isolate causal variables), under some circumstances even preschoolers can generate simple controlled experiments during free play. To what extent do young children verbalize reasoning about their own spontaneous experiments? Forty-two children ages 4-6 years old explored and played with shapes in an interactive game on a touch screen tablet. A large majority of children generated “controlled experiments” during their play, and the majority of these children mentioned their discoveries in reply to subsequent open-ended questions (“what did you find out when you were playing?,” or a follow-up question, “what do you think makes the machine go?”). These findings suggest that young children tend to self-report causal learning from their own spontaneous controlled experiments.

Any connections you have identified between the specific research studies and museum educational practices: Through the utilization of the preliminary results obtained during these studies, Phipps’ education staff has been able to gain better insight into the learning and exploration processes of children, and as a result have been able to adapt museum tabling displays and interactions in ways that allow them to actively utilize and practice said findings.

Has anything notable or surprising occurred conducting research through Living Laboratory? On one visit musicians unexpectedly made it impossible to conduct research with children.

Outcomes and Future Goals:

What is the next step for Living Laboratory? The next step for Living Laboratory is to continue and further expand upon science communication skills in academic partners through training and practice, and to contribute to museum staff and visitors’ increased understanding of scientific thinking and the process of scientific investigations through our continued interaction with these active studies. Phipps will work together with future academic partners to pay special attention to goals that were difficult to meet in this year’s partnership. We have had an initial meeting with Dr. Anna Fisher to discuss incorporating the Living Laboratory model, complete with mutual PD and tracking educational opportunities, into our ongoing collaboration, and are hoping to grow the program with additional interested researchers.

Any unintended benefits or outcomes so far? 1. Identified ideal locations in Phipps for researchers to interact with visitors while maintaining appropriate research space; 2. Improved ability to track overall impact; 3. Gained mutual knowledge and respect for work of museum staff and university researchers; 4. Lab staff became more conscious of quality of interactions with visitors, and the potential for visitor education; 5. “Ask a Scientist” program gave additional educational opportunities to museum visitors, enhancing public programming interest and attendance.

